Expert Rebuttal Report

Of

Stephen D. Emsbo-Mattingly

Provided in the following litigation pending in the District Court for the Eastern District of North Carolina, Western Division:

5:08-cv-00460-FL Duke Energy Progress, Inc. v. 3M Company, et al.
and
5:08-cv-00463-FL Consolidation Coal Company v. 3M Company, et al.

September 5, 2014

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INTRODUCTION

This report sets out my opinions about the limitation of the historical data to ascertain the date of release for polychlorinated biphenyls (PCBs) at the Ward Transformer Site. My opinions include a description of the existing data and the factors needed to date the release of the detected PCBs. This report is offered in rebuttal to the 2011 and 2014 opinions and 2012 deposition testimony of Plainitffs' expert Gary Collison concerning the timing of releases of PCBs at and from the Site.

QUALIFICATIONS TO PROVIDE EXPERT OPINIONS

I am a Senior Scientist and Partner with NewFields Environmental Forensics Practice, LLC located in Rockland, Massachusetts. I am a chemist with over 25 years of postgraduate and professional working experience in the field of environmental chemistry. I hold a Master's of Science (M.S.) in environmental science from the University of Massachusetts and a Bachelor's degree from Oberlin College. My resume is presented in Attachment 1.

I directed organic and inorganic laboratories for more than 10 years and performed several hundred forensic investigations concerning chlorinated organic compounds, hydrocarbons, and heavy metals throughout the United States under contract with USEPA, NOAA, various State agencies, and numerous private companies. I authored or co-authored over 100 professional publications and presentations (Attachment 1), including textbook chapters concerning the environmental forensics aspects of chemical source identification and interpretation that are relevant to this investigation. I provided expert testimony on five occasions since 2000 including one mediation (Attachment 2). I currently serve on the Editorial Board of the *International Journal of Environmental Forensics*.

COMPENSATION

I am compensated at the rate of $200/hour for study, deposition and testimony.

INFORMATION RELIED UPON

In the process of preparing this report, I have reviewed and relied upon case-specific documents such as reports, maps, aerial photographs, chemistry data, and other documents that were developed during the course of numerous investigations conducted in regard to this matter. A listing of the documents and data my colleagues and I reviewed and relied upon is provided in Attachment 3.

The environmental samples that support my forensic investigation were collected during the contaminant investigation and remediation. NewFields used these data to create a cumulative database containing all available analytical data. Additional data and site information, such as aerial photos and site maps are included to place the chemical patterns observed in the study area geographic context. Every effort was made to include all of the sample and site information available for this investigation and no sample data were intentionally omitted. The complete database is included in the Ward Transformer Database submitted with this report (Attachment 4).

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In addition to site-specific data and reports, I have relied upon published papers and books that are pertinent to the chemistry and fate of PCBs and other related contaminants in the environment, as well as facts or data reasonably relied upon by professionals in my field as referenced herein.

I reserve the right to modify and supplement opinions expressed in this report as further information becomes available, including through disclosure of information not yet reviewed by this author, the depositions of Plaintiffs' experts, and any subsequent sampling and analyses. I reserve the right to express new opinions in response to new information or opinions expressed by Plaintiffs' experts.

SITE DESCRIPTION

Stanley (1994) and Weston (2004) described the site history in sufficient detail for this forensic evaluation. The Ward Transformer site in Raleigh, Wake County, North Carolina was formerly owned by the Ward Transformer Company a/k/a Ward Sales & Service, Inc. (Ward). The site was built on approximately eleven (11) acres of previously undeveloped land in 1964 and used to build and sell new transformers, store for resale inventoried transformers and consignment transformers, and repair and recondition transformers. The operational period extended from 1964 to 2006 during which the plant configuration evolved.

Spatial Domains

Multiple spatial domains were established to evaluate the relationship between site operations and the historical PCB releases. The spatial domains assigned for this evaluation included:

- Transformer Reconditioning Building (Onsite) constructed in 1965, operated until 2006, enlarged processing area in 1969, added office in 1982, and added Blue Annex between 1996-2002;
- Transformer Storage Yard (Onsite) operated from 1965 to 2006
- Tank Farm (Onsite) increased from 3 to 7 ASTs around 1979;
- Gravel Parking Lot (Onsite) constructed circa 1979 and operated until 2006;
- Water Treatment Plant Office (Onsite) constructed between 1979 and 1981, operated until 2006;
- Stormwater Lagoon (Onsite) constructed around 1972, operated until 2006;
- Horizon Forest Property (Onsite) operated from 1974 to 2006;
- Estes Operation (Offsite) constructed circa 1973 and remains in operation;
- Offsite East
- Offsite South
- Offsite West
- Offsite North
- Unnamed Tributary (Offsite)
- Little Brier Creek Upstream (Offsite)
- Little Brier Creek Downstream (Offsite)
- Remedial Investigation Area (Offsite)
- Construction Delineation Area (Offsite)

Contamination Discovery (1978 -1979)
As a result of the PCB Roadside Spill and prosecution of company President Buck Ward and his son, investigations of the Ward Site itself were initiated by the United States Environmental Protection Agency (USEPA). That investigation demonstrated extensive PCB contamination in the onsite soil, the stormwater lagoon water and sediment, and the water and sediments along the offsite surface water pathway draining the site. Aroclor 1260 (PCB 1260) was the major PCB contaminant detected (USEPA, 1978; USEPA, 1979; Shifrin, 2014).

Reformed Ward Operations (1978-2006)
Given EPA's investigation and the state and federal criminal cases pending against Ward's President and Vice President, Ward instituted many changes beginning in 1978. Some of these changes included:

- Spill Prevention and Control Countermeasures Plan;
- Employee spill response training;
- Procurement of spill cleanup equipment;
- Routine inspections for leaking transformers;
- Monthly reporting;
- Enclosed oil transfer pumping procedures;
- Daily cleanup procedures;
- Oil storage tank dykes;
- Surface water management systems; and
- Tank Farm Expansion from 3 to 7 Tanks for Transformer Fluid Containment.

In addition, transformers were tested prior to receipt. Those transformers containing less than 50 ppm PCBs were considered non-PCB transformers and were accepted onsite at Ward. Transformers containing 50 – 500 ppm PCBs were required to be drained prior to shipment to Ward. By 1978, Ward refused to accept transformers which contained fluid with greater than 500 ppm PCBs. Transformers onsite were stored for re-sale and/or were reconditioned onsite (WTC, 1979; NC DEHNR, 1995).

Closure and Cleanup (2006 to Present)
Following the closure of the transformer plant in 2006, excavation was conducted to clean up the site to a soil removal level of less than 1ppm PCBs. Excavated soils with PCB concentrations less than 50 ppm were disposed of off-site. Excavated soil with PCB concentrations greater than or equal to 50 ppm was treated in a Low Temperature Thermal Desorption (LTTD) unit to concentrations less than 1 ppm and backfilled on the Ward Transformer property.

PCB FORENSICS

PCBs are a class of chlorinated organic compounds that, due to their chemical and physical stability, were used in a variety of commercial and industrial applications in the United States between 1929 and 1977 (ATSDR, 2000; USEPA, 1976). They are not known to occur naturally. The manufacturing of specific PCB products is an important consideration when constraining the date of release, because the formulation of transformer fluids changed over time.

Aroclor Composition

Monsanto manufactured a range of PCB products and marketed them under the trade name "Aroclor." Each Aroclor product contained a subset of 209 possible PCB congeners. Each congener contains between 1 and 10 chlorine atoms. Each congener differed in terms of the number and position of the chlorines on the biphenyl molecule. Each Aroclor was formulated for a range of different commercial and/or industrial applications (Monsanto, 1960; Erikson, 1997; ATSDR, 2000). For example, Aroclors 1242, 1016, 1248, 1254 and 1260 performed exceptionally well in electrical equipment as dielectric fluids (Table 1).

Askarels

Askarels are a subclass of dielectric fluids used in transformers and other electrical equipment. They contain pure Aroclors or mixtures of Aroclors and polychlorinated benzenes formulated specifically for liquid filled transformers, capacitors, switches, and terminal chambers (Monsanto, 1963a; Monsanto, 1971; USEPA, 1976). The primary advantage of PCB dielectric fluids compared to mineral oils is that they are non-flammable and very stable, which extends the service life of the electrical equipment (Monsanto, 1971). However, they are more expensive and toxic. Accordingly, they are primarily used for electrical equipment with secondary containment that is located in buildings and underground. The operational lifetime of PCB transformer fluids is thought to be 30 to 40 years under normal operating conditions. Monsanto provided instruction for the monitoring of Askarel quality to assure the timely replacement of the fluid before its deterioration resulted in expensive equipment damage (Monsanto, 1963b).

Formulation Changes Over Time

The Askarel formulation changed over time (Table 1). Prior to the early 1970's, transformer Askarels with trade names, such as Pyranol, Inerteen, Chlorextol, Noflamol, and Saf-T-Kuhl, consisted of Aroclor 1260 mixed with trichlorobenzenes or trichlorobenzenes and tetrachlorobenzenes. In the early 1970's, Monsanto phased in other transformer Askarel formulations that included Aroclors 1242 and 1254 (ASTM D2283). Capacitor Askarels contain Aroclors 1242, 1254, or 1016; or mixtures of Aroclors 1254 and trichlorobenzenes (ASTM D2233-86). Askarel formulations also included scavengers to prevent the accumulation of corrosive gas; i.e., hydrogen chloride. The scavengers included phenoxypropene oxide (glycidyl-phenyl ether); diepoxide (3,4-Epoxycyclohexylmethyl-3,4-epoxycyclohexane carboxylate); or tin tetraphenyl. Forensically, the characterization of the Aroclor type, polychlorinated benzene composition, and scavenger compounds provide the means to forensically identify the PCB product (Table 1) and, thereby, estimate the date of its manufacture, and constrain its date of release.

Spatial Distribution

The spatial distribution is also an important consideration when constraining the date of release for PCB products. PCB non-aqueous phase liquids (NAPLs) typically have specific gravities greater than 1, which means they are more dense than water and are therefore dense non-aqueous phase liquids (DNAPLs). In practice, DNAPLs sink through the void (i.e., empty) spaces between soil particles that are normally filled with soil gas and groundwater until they encounter a confining layer of soil that is too dense to penetrate or become so diluted by mixing with soil particles that the PCBs lack a sufficient mass to flow under ambient conditions. NAPLs can migrate from their points of discharge through the subsurface, or be transported along or through a preferential pathway like a pipe, sewer, or drainage ditch, to subsurface, surface, or sediment locations some distance from the point of discharge. The NAPL eventually binds with soil and sediment particles which remain buried or migrate downstream especially when eroded or resuspended during storm events. The adsorbtion, migration and mixing of PCB-containing fluids can take a long time. However, the re-grading of the Ward and Estes properties prior

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to 1979 likely redistributed the PCB contamination around these properties relatively quickly. The spatial distribution of PCBs within the study area is consistent with a combination of these long-term natural and short-term anthropogenic activities.

Proximity to Historical Operations

The PCB concentration gradient and proximity to historical operations helps identify the likely activity or equipment that caused the release. The highest PCB concentrations generally coincide with the point of release. The declining PCB concentration represents the mixing of PCB-containing transformer fluids with ambient soil, sediment, or other media. The historical activity that occurred near the highest PCB concentrations provides a line of evidence that can help constrain the date of release. Similarly, the collection of samples over time (e.g., pre- and post-1978) in the areas of alleged discharge can help constrain the date of release.

Observed PCB Concentrations

Descriptive statistics calculated on the Ward Transformer Database (Attachment 4) help demonstrate the occurrence of PCB Aroclors in each domain (Table 2). The maximum total PCB Aroclor concentration occurred in Transformer Storage Yard soil (TPCB maximum = 13,000 mg/kg) followed by Stormwater Lagoon sediment (TPCB maximum = 2,900 mg/kg) and soil (TPCB maximum = 1,400 mg/kg). This finding suggests that PCB-containing transformer fluids were released or accumulated in these areas. The elevated concentrations of Total PCB Aroclors declines between the Offsite West (TPCB maximum soil = 1,500 mg/kg), the Unnamed Tributary (TPCB maximum soil = 280 mg/kg and TPCB maximum sediment = 62 mg/kg, and the Little Brier Creek (TPCB maximum sediment = 4.2 mg/kg). The declining PCB concentration signifies the dilution of the PCBs as they migrated offsite and mixed with ambient soils and sediments.

The composition of the soil, sediment, and solid samples is fairly uniform (Attachment 4). Of the 1391 samples tested for PCB Aroclors, 1158 (83%) contained detectable concentrations of PCBs. Aroclor 1260 was detected in 100% of the soil, sediment, and solid samples with PCB detections. Only 16 (1.2%) of the soil, sediment, and solid samples contained Aroclor 1254 and all of these samples also contained Aroclor 1260. Only 21 (1.5%) of the soil, sediment, and solid samples contained chlorobenzenes[1] and all of these samples also contained Aroclor 1260. These samples were neither measured for all six trichlorobenzene and tetrachlorobenzene isomers, nor any of the Askarel scavengers. In summary, the overwhelming majority of the soil, sediment, and solid samples contained Aroclor 1260, fewer than 2% of them contained other Aroclors or chlorobenzenes, and none of these samples were measured for all chlorobenzene isomers and Askarel scavengers needed to accurately identify transformer fluid product or estimate its manufacturing date based on the chemistry alone.

[1] The chlorobenzene compounds measured in the field samples included a maximum of the following: chlorobenzene, 1,2-dichlorobenzene, 1,3-dichlorobenzene, 1,4-dichlorobenzene, 1,2,4-trichlorobenzene, and hexachlorobenzene. Tetrachlorobenzene and pentachlorobenzene isomers were not measured in any of the samples.

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OPINIONS

Opinion 1. There are well recognized forensic methods for identifying the date of manufacture of PCB-containing transformer fluids and this methodology requires measurement of trichlorobenzenes, tetrachlorobenzenes, and scavengers. The parties who investigated the Ward site, including the Plaintiffs, did not take those critical measurements. At this point, it is too late to reconstruct those measurements. The failure to take these measurements prevents a forensic chemist from being able to date the PCBs identified in the samples relied upon by Mr. Collison. Therefore, the historical data do not support Mr. Collison's opinion that PCB fluids continued to be released onsite after 1978.

The historical data demonstrate several important forensic features. First, the concentration of total PCBs was high onsite and declined with increasing distance offsite (Figure 2). This spatial pattern is consistent with onsite releases that migrated downstream. Second, Aroclor 1260 is present in more than 99% of the 1391 field samples (Figure 3). This finding is consistent with the release of PCB-containing transformer fluids manufactured between approximately 1932 and 1970 (Table 1). Third, the onsite PCB concentrations were highest near the transformer storage yard and former lagoon where transformer fluid releases occurred (Figure 4). The number of different hot spots indicates multiple discharge points or the complex redistribution of PCBs when the properties were re-graded before 1979. Fourth, a small number of these samples contained Aroclor 1254 and one sample contained Aroclor 1242 (Figure 5). This observation may demonstrate the release of PCBs from non-transformer equipment or transformer fluids manufactured between 1970 and 1977 (Table 1).

The historical data do not include measurements of many forensically important analytes. Some of the samples were measured for trichlorobenzenes, dichlorobenzenes, and chlorobenzenes. The samples with mixtures of chlorobenzenes and PCBs contained Aroclor 1260. This finding signifies the presence of Askarels. Unfortunately, most of the samples measured for Aroclors were not tested for trichlorobenzenes and none of the samples were tested for tetrachlorobenzenes or scavengers (i.e., phenoxypropene oxide, diepoxide, and tin tetrachloride). Consequently, the historical data offer insufficient information to determine the specific transformer fluid identities or, therefore, the approximate date of manufacture. It is my understanding that the historical samples have not been properly archived for supplemental testing and the historical contamination has largely been remediated. Therefore, the ability to perform supplemental testing is no longer possible. Therefore, the historical data do not support Mr. Collison's opinion that PCB fluids continued to be released onsite after 1978.

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Opinion 2. The spatial distribution of PCB contamination and the testimony and other evidence from Ward and Ward employees are consistent with the proposition that PCB contamination at the Ward site relates primarily if not wholly to releases that occurred before 1978.Therefore, Mr. Collison's opinion that that Ward continued to release PCBs from the site up until the time that Ward ceased operation is not supported.

The site history and spatial distribution of PCBs indicate that the rehabilitation of transformers resulted in significant releases of PCB-containing transformer fluids before 1978. After 1978, the concentration of PCB releases likely declined based on the implementation of environmental control procedures (e.g., transformer fluid testing prior to arrival, spill response upgrades, stormwater control systems, and offsite disposal of PCB-contaminated fluids). However, this conclusion cannot be supported by the generic PCB testing procedures reflected in the historical database. The failure to 1) measure diagnostic Askarel constituents, such as trichlorobenzenes, tetrachlorobenzenes, and scavengers; and 2) measure PCBs in soils before and after 1978 compromised the ability of forensic investigators to conclusively identify the date transformer fluid manufacture and infer the date of release based on the chemical signatures. As above, it is my understanding that the historical samples have not been properly archived for supplemental testing and the historical contamination has largely been remediated. Therefore, the ability to perform supplemental testing is no longer possible.

However, the site history, spatial distribution of PCBs, and the testimony about improved equipment and oil handling practices at Ward after the arrest and conviction of Ward's President for the road-side spraying provides support for the proposition that the PCB contamination at the Ward site was attributable to PCB releases before 1978. The migration of contaminants from the source areas took a long time with some acceleration due to the re-grading of the Ward and Estes properties before 1979. Mr. Collison's opinions, including those offered in his 2012 deposition, that Ward continued to release PCBs from the site up until the time that it ceased operation is not supported.

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American Standards and Testing Materials (1997b). D2283-86: Standard Specification for Chlorinated Aromatic Hydrocarbons (Askarels) for Transformers. Reapproved 1997.

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Table 1. Chemical and Physical Properties of PCB Aroclors and Askarels.

Product (Years Produced) approximate	CAS Number	Molecular Formula (average)	Percent Chlorine (approx.)	Specific Gravity *	Physical State 25°C 1 atm	Description	Ref
Aroclor 1242 (~1930 to 1977)	53469-21-9	(C12H7Cl3)	42	1.30-1.39 25°C/15.5°C	mobile oil	clear	1,2
Aroclor 1254 (~1930-1977)	11097-69-1	(C12H5Cl5)	54	1.49-1.50 65°C/15.5°C	viscous liquid	light yellow	1,2
Aroclor 1260 (~1930-1972)	11096-82-5	(C12H4Cl6)	60	1.55-1.56 90°C/15.5°C	soft, sticky resin	light yellow	1,2
Trichlorobenzenes 1,2,3- 1,2,4- 1,3,5-	Three Isomers 87-61-6 120-82-1 108-70-3	C6H3Cl3	59	1.46 - 1.69 Temp NA	liquid/ crystalline powder	clear/ white-baige	3
Tetrachlorobenzenes 1,2,3,4- 1,2,4,5- 1,2,3,5-	Three Isomers 634-66-2 95-94-3 634-90-2	C6H2Cl4	66	1.73 - 1.86 Temp NA	crystalline powder	white-baige	3
Transformer Askarel Pyranol 1448 (1932-1944)	60% AR1260 40% TriCB	(C10H3Cl5)	59	1.560 to 1.568 15.5/15.5°C	mobile oil	clear	4,6
Transformer Askarel Inerteen (1933-1949)	60% AR1260 40% TriCB	(C10H3Cl5)	59	1.560 to 1.568 15.5/15.5°C	mobile oil	clear	4
Transformer Askarel Pyranol 1467 (1944-1952)	60% AR1260 40% TriCB 0.125% Scav 1	(C10H3Cl5)	59	1.560 to 1.568 15.5/15.5°C	mobile oil	clear	4,6
Transformer Askarel Inerteen PPO Introduced 1949	60% AR1260 40% TriCB	(C10H3Cl5)	59	1.560 to 1.568 15.5/15.5°C	mobile oil	clear	4
Transformer Askarel Pyranol 1470 (1952-1963)	45% AR1260 40% TriCB 15% TetraCB 0.125% Scav 1	(C9H3Cl5)	61	1.560 to 1.571 15.5/15.5°C	mobile oil	clear	4,5,6
Transformer Askarel Pyranol 1497/A13B3B (1963-1970)	45% AR1260 40% TriCB 15% TetraCB 0.125% Scav 2	(C9H3Cl5)	61	1.560 to 1.571 15.5/15.5°C	mobile oil	clear	4,6
Transformer Askarel Pyranol A13B3B2 (1970-1974)	45% AR1254 40% TriCB 15% TetraCB 0.125% Scav 2	(C9H4Cl4)	57	1.515 to 1.525 15.5/15.5°C	mobile oil	clear	4,6
Transformer Askarel Pyranol A13B3B3 (1974-1977)	60% AR1254 40% TriCB 0.125% Scav 2	(C10H4Cl4)	56	1.495 to 1.510 15.5/15.5°C	mobile oil	clear	4,6

Notes:
NI - No information
* Specific Gravity:
Ratio of weights of equal volumes of product and water at specified temperatures

Scavengers:
1. Tetraphenyl tin
2. 3,4-Epoxycyclohexylmethyl-3,4-epoxycyclohexane-carboxylate

References:
1. Monsanto, 1971
2. Monsanto, 1995
3. Beck&Loser, 2011
4. Monsanto, 1950's
5. Monsanto, 1963a
6. Fessler, 1979

Table 2. Total PCB Aroclor Concentrations by Domain and Matrix.

Domain	Matrix	Count	Units	Average	Median	95th Percentile	Maximum
Transformer Reconditioning Building	Soil	17	mg/kg	8.21	0.02	33.6	120
Transformer Storage Yard	Soil	138	mg/kg	310	13.0	922	13,000
Transformer Storage Yard	Solid	5	mg/kg	84.6	93.0	162	170
Tank Farm	Soil	5	mg/kg	1.18	0.39	2.96	3.10
Gravel Parking Lot	Soil	35	mg/kg	5.60	0.09	19.1	140
Stormwater Lagoon	Soil	46	mg/kg	114	9.35	678	1,400
Stormwater Lagoon	Solid	1	mg/kg	71.0	71.0	71.0	71.0
Stormwater Lagoon	Sediment	11	mg/kg	506	37.0	2,180	2,900
Horizon Forest Property	Soil	41	mg/kg	6.93	0.13	28.0	160
Horizon Forest Property	Solid	26	mg/kg	65.7	40.0	280	390
Estes Property	Soil	114	mg/kg	8.07	1.60	27.1	200
Estes Property	Solid	2	mg/kg	nd	nd	nd	nd
Estes Property	Sediment	2	mg/kg	0.04	0.04	0.07	0.07
Offsite West	Soil	42	mg/kg	85.9	0.77	418	1,500
Offsite West	Water	3	mg/L	nd	nd	nd	nd
Offsite South	Soil	44	mg/kg	3.99	0.74	10.8	58.0
Offsite East	Soil	34	mg/kg	13.5	0.63	87.8	190
Offsite North	Soil	3	mg/kg	0.03	nd	0.08	0.09
Unnamed Tributary	Soil	34	mg/kg	21.4	2.35	130	280
Unnamed Tributary	Sediment	42	mg/kg	10.7	3.20	43.8	62.0
Little Brier Creek Downstream	Sediment	51	mg/kg	0.78	0.40	2.60	4.20
Remedial Investigation Area	Sediment	2	mg/kg	0.02	0.02	0.04	0.05
Construction Delineation Area	Soil	3	mg/kg	3.90	4.40	5.12	5.20
Not defined	Soil	490	mg/kg	41.8	0.61	250	1,700
Not defined	Solid	95	mg/kg	74.1	6.20	413	1,200
Not defined	Sediment	55	mg/kg	0.03	nd	0.21	0.48
Not defined	Water	7	mg/L	2.30	nd	11.2	16.0
Not defined	Wipe	43	varies	2.32	nd	10.5	34.0
Total		1391					

Not defined - samples that do not have coordinates (e.g., excavation pile samples) or were collected outside the area depicted in the figures in this report.
Solids include solid media other than soils and sediments (e.g., ash, brick, concrete, wood chips, etc...)

Figure 1. Ward Transformer Site and Spatial Domains.

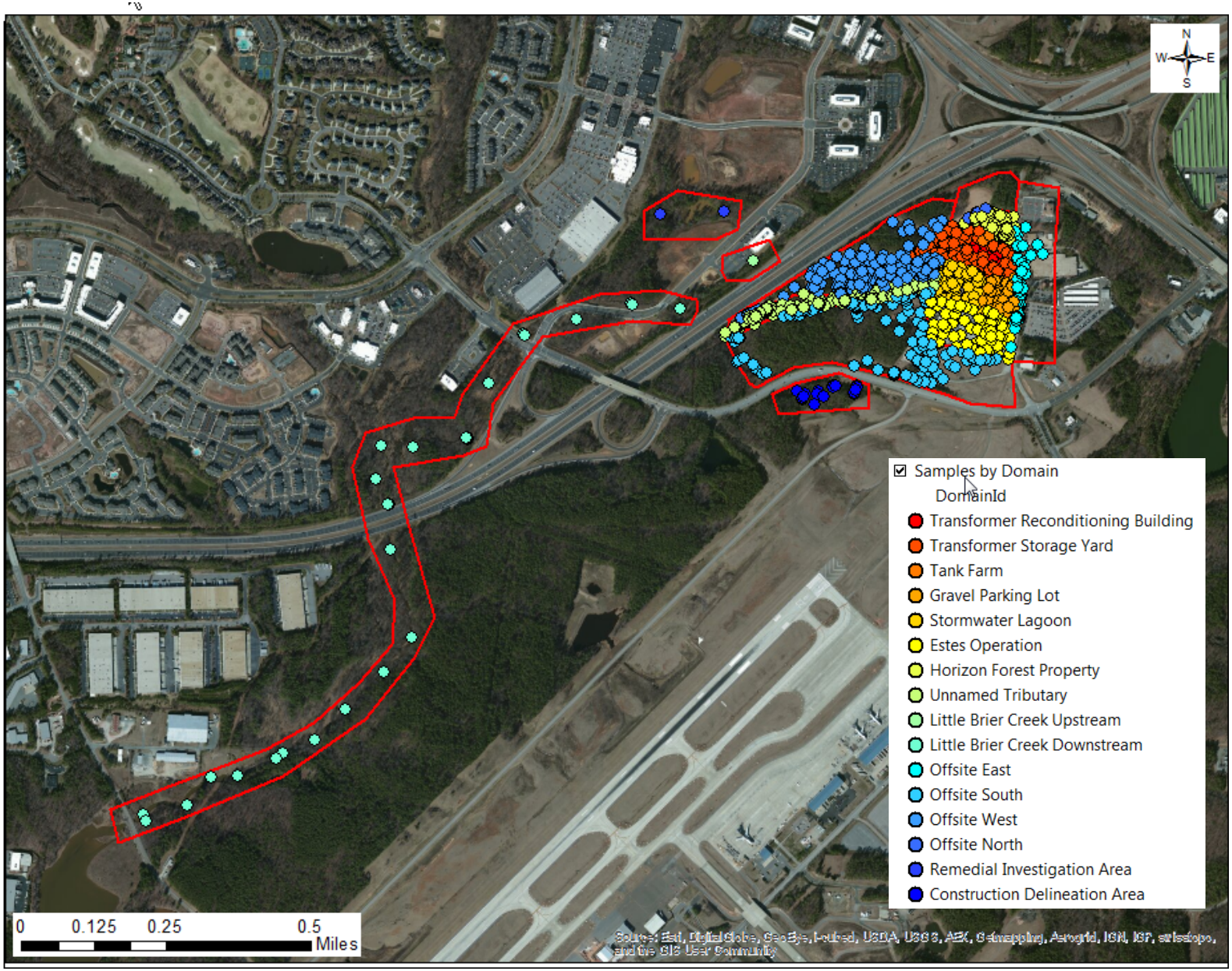

Figure 2. PCB Concentrations in the Study Area.

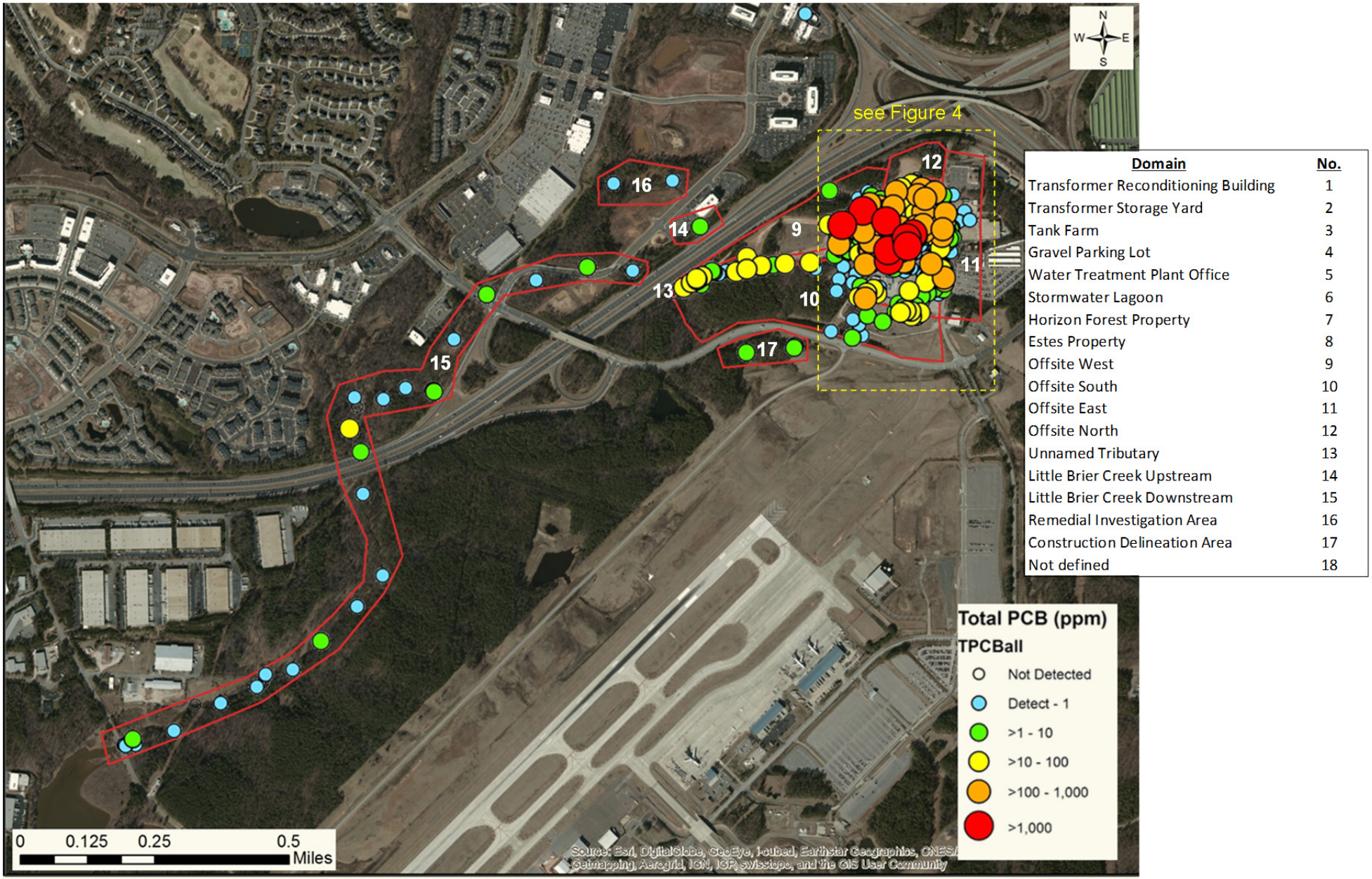

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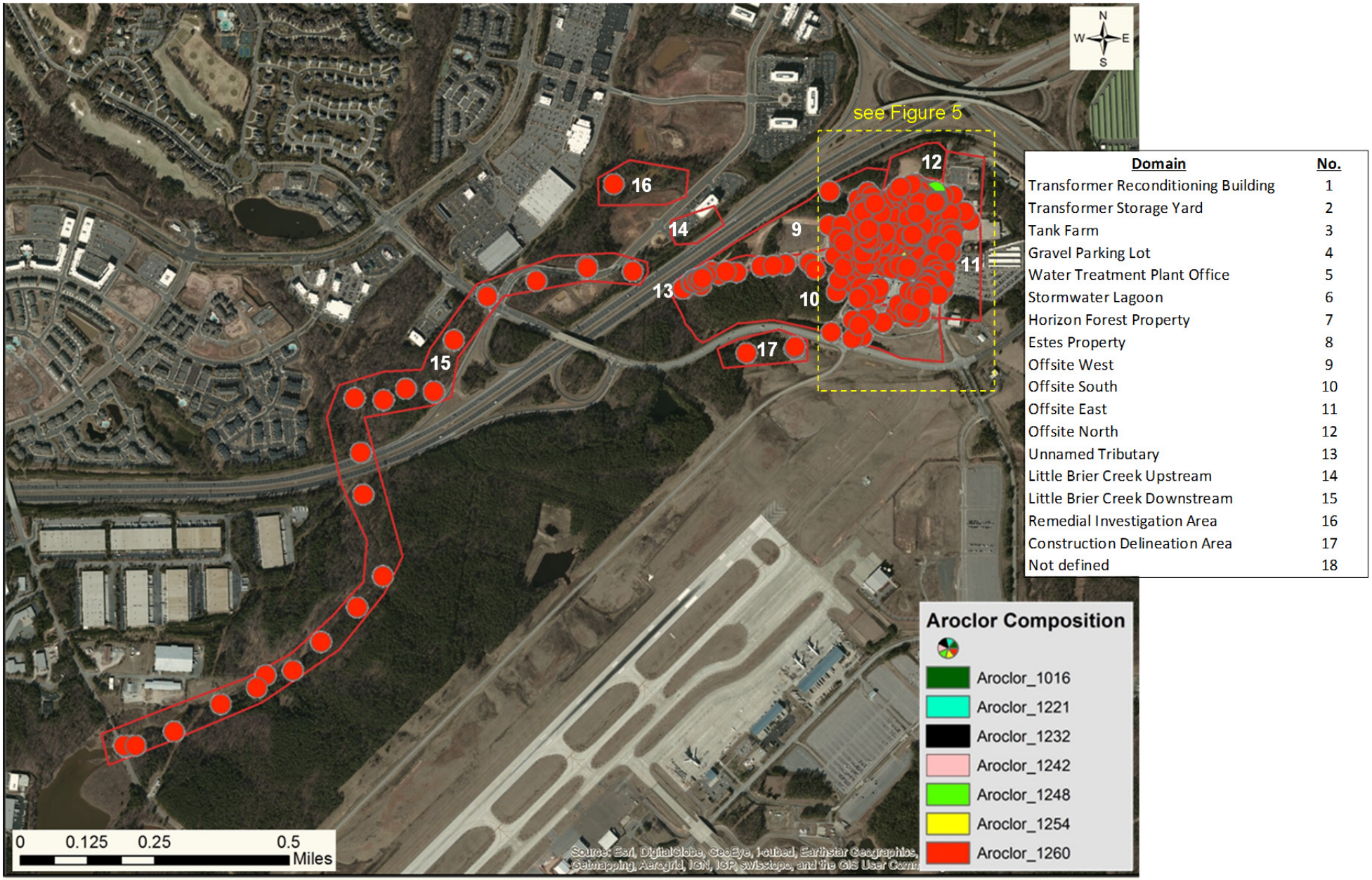
Figure 3. PCB Composition in the Study Area.



Domain	No.
Transformer Reconditioning Building	1
Transformer Storage Yard	2
Tank Farm	3
Gravel Parking Lot	4
Water Treatment Plant Office	5
Stormwater Lagoon	6
Horizon Forest Property	7
Estes Property	8
Offsite West	9
Offsite South	10
Offsite East	11
Offsite North	12
Unnamed Tributary	13
Little Brier Creek Upstream	14
Little Brier Creek Downstream	15
Remedial Investigation Area	16
Construction Delineation Area	17
Not defined	18

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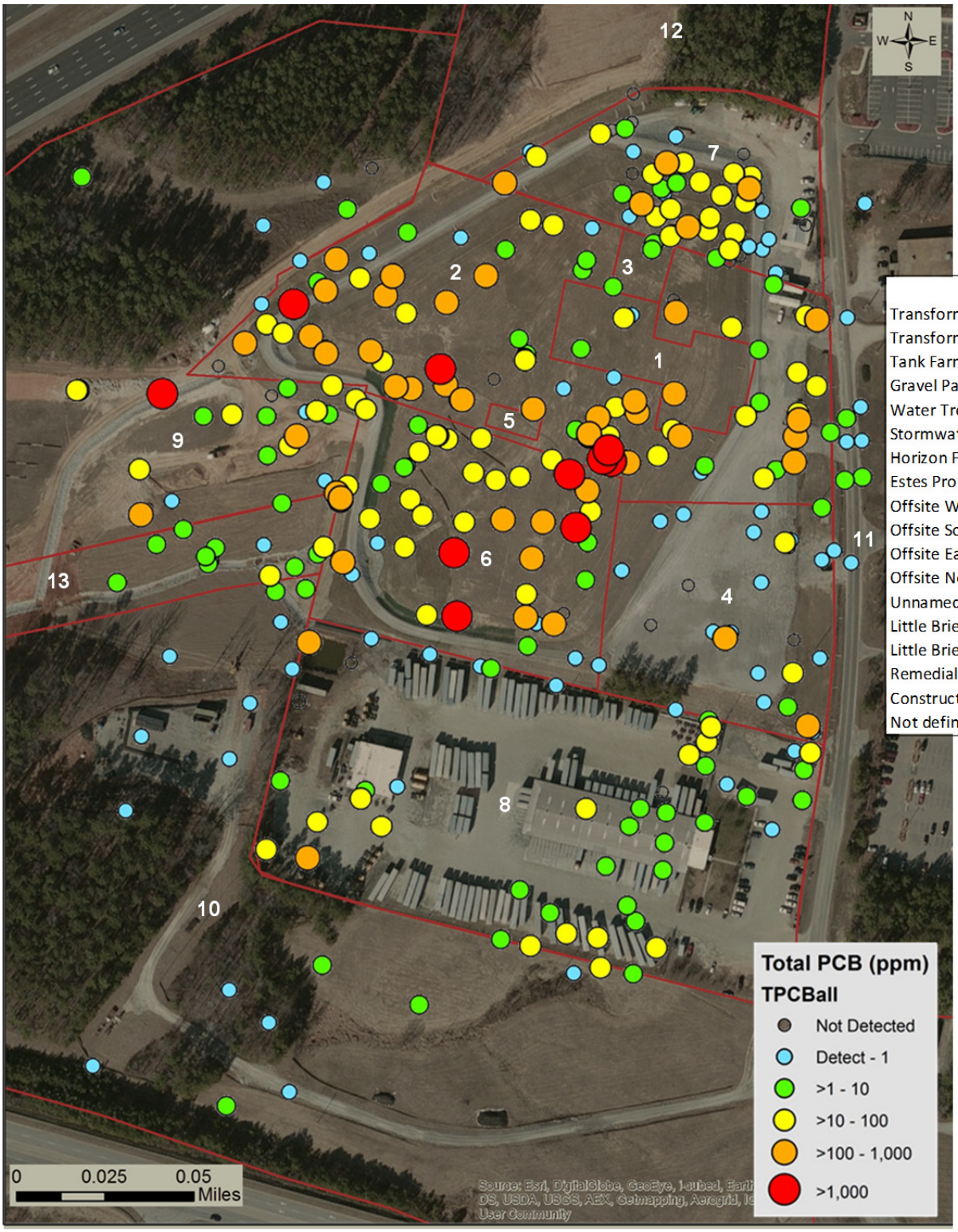
Figure 4. Total PCB Concentrations in Soil, Sediment, and Solid Samples.



Domain	No.
Transformer Reconditioning Building	1
Transformer Storage Yard	2
Tank Farm	3
Gravel Parking Lot	4
Water Treatment Plant Office	5
Stormwater Lagoon	6
Horizon Forest Property	7
Estes Property	8
Offsite West	9
Offsite South	10
Offsite East	11
Offsite North	12
Unnamed Tributary	13
Little Brier Creek Upstream	14
Little Brier Creek Downstream	15
Remedial Investigation Area	16
Construction Delineation Area	17
Not defined	18

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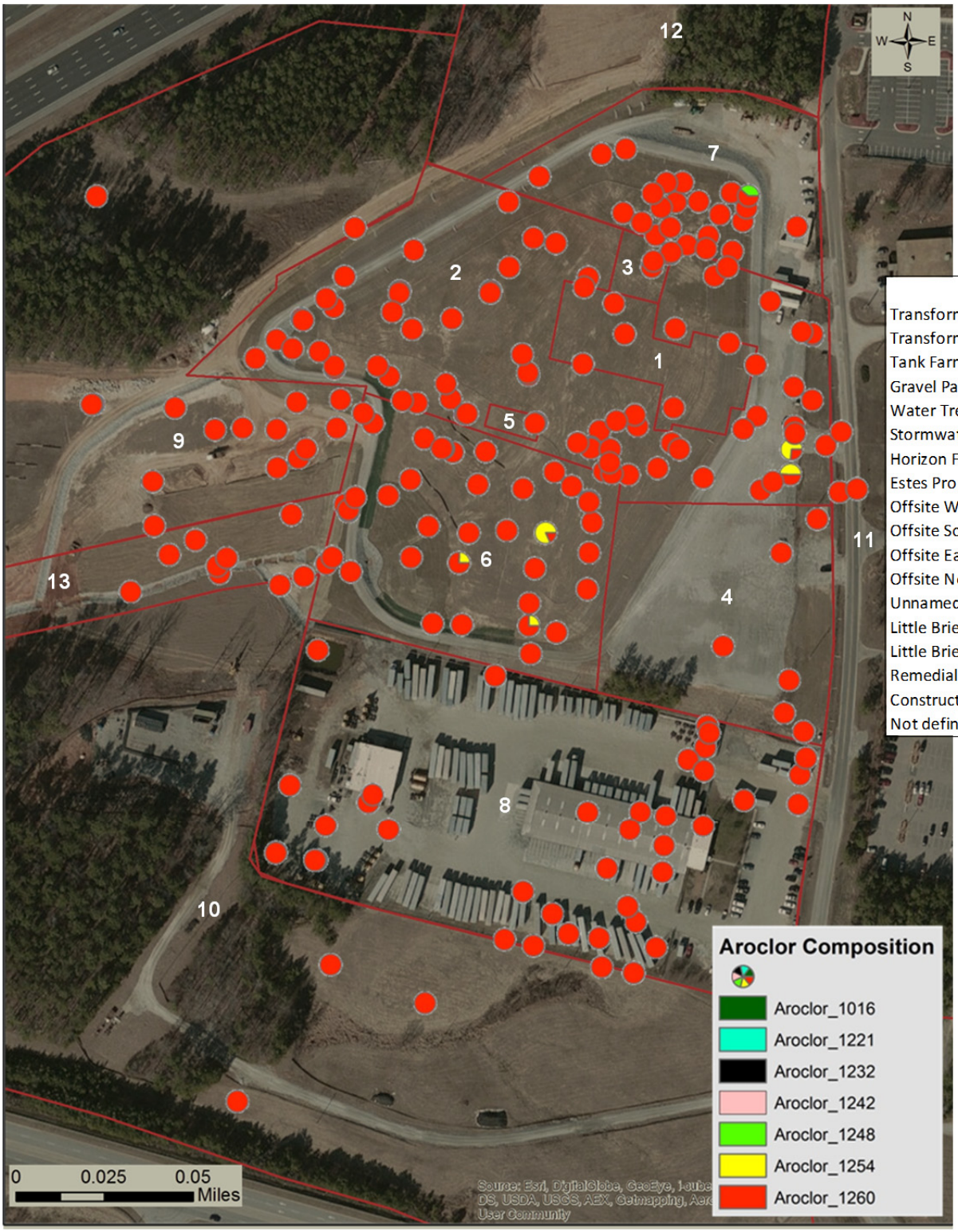
Figure 5. PCB Composition in Soil, Sediment, and Solid Samples.



Domain	No.
Transformer Reconditioning Building	1
Transformer Storage Yard	2
Tank Farm	3
Gravel Parking Lot	4
Water Treatment Plant Office	5
Stormwater Lagoon	6
Horizon Forest Property	7
Estes Property	8
Offsite West	9
Offsite South	10
Offsite East	11
Offsite North	12
Unnamed Tributary	13
Little Brier Creek Upstream	14
Little Brier Creek Downstream	15
Remedial Investigation Area	16
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Not defined	18

Attachment 1
Resume for Stephen D. Emsbo-Mattingly, M.S.

www.NewFields.com 300 Ledgewood Place, Suite 305, Rockland, Massachusetts 02370 T. 781.681.5040

STEPHEN D. EMSBO-MATTINGLY, M.S.

Senior Chemist/Consultant

Environmental Forensics Practice

EXPERIENCE SUMMARY

Mr. Emsbo-Mattingly specializes in the diagnostic measurement of polychlorinated biphenyls (PCBs), petroleum, petrochemicals, fuels, combustion byproducts, dioxins, tar, coke, coal, carbonization byproducts, chlorinated solvents, heavy metals, and other industrial products in various environmental media. He has conducted more than 200 environmental chemistry and forensic investigations at electric utilities, substations, transformer recycling operations, petroleum storage facilities, petroleum refineries, marine terminals, former manufactured gas plants (MGPs), paper mills, wood treating facilities, tar refineries, coke plants, dry cleaners, chemical plants, chlorinated solvent manufacturers, metallurgical operations. Many of these projects required an evaluation of historical chemistry results and ambient background conditions associated with off-site and non-point releases from urban background or regional storm sewers. Most forensic investigations also required detailed study design, workplans, sample collection, and analysis of laboratory data and quality control performance. Mr. Emsbo-Mattingly's past technical and expert reports were commissioned on behalf of both private companies and regulatory agencies.

Mr. Emsbo-Mattingly possesses 25 years of forensic chemistry experience. He directs and manages forensic chemistry projects throughout the United States involving the identification of fugitive products containing hydrocarbons, PCBs, Askarels, polycyclic aromatic hydrocarbons (PAHs), soot, polychlorinated dibenzo-p-dioxins and polychlorinated dibenzofurans (PCDD/PCDFs), tar, coke, petrochemicals, chlorinated solvents, organochlorine and organophosphorus pesticides, and other anthropogenic materials. His most recent casework involves site and liability assessments associated from releases of electrical equipment fluids, tar byproducts, petroleum, building fires, dry cleaners, chemical manufacturers, coking plants, wood preserving plants, pipelines, gasoline service stations, refineries and railroad operations. The diagnostic indicator compounds used most effectively in his research include PCB Aroclors/congeners/homologues, parent and alkylated PAHs, chlorinated solvents, pesticides, PCDD/PCDF extended isomers, volatile and semivolatile organics, alkylated benzenes, alkylated cyclohexanes, alkylated leads, biomarkers, fuel additives, and chlorophenols. His projects have featured numerous emerging forensic methods (organic petrology, stereomicroscopy, scanning electron microscopy, energy dispersive x-ray spectrometry, compound-specific isotope ratio mass spectrometry, hydrocarbon soluble metals, Fourier transformed ion cyclotron resonance mass spectrometry) and interpretive techniques (chemometrics, geostatistical, and data visualization software tools).

As indicated below, most Mr. Emsbo-Mattingly's recent publications focus on the differentiation sources of PCBs, hydrocarbons, solvents, and PCBs in sediment, soil, tissue, and air media. Prior to joining NewFields Mr. Emsbo-Mattingly was a Principal Research Scientist at Battelle Memorial Institute after directing the operations of the META forensic laboratory and the E3I full service environmental laboratory.

EDUCATION AND TRAINING
M.S., Environmental Science, University of Massachusetts, 1994
B.A., Biology, Oberlin College, 1988

EMPLOYMENT HISTORY

Energy & Environmental Engineering (E3I): 1988 to 1996
META Environmental, Inc. (META): 1996 to 2000
Battelle Memorial Institute (BMI): 2000 to 2004
NewFields Environmental Forensics Practice, LLC (NF): 2004 to Present

PROFESSIONAL AFFILIATIONS

American Chemical Society
Society of Environmental Toxicology and Chemistry
Air and Waste Management Association
American Wood Protection Association
Society for Industrial Archeology

REPRESENTATIVE PROJECT EXPERIENCE

PCB and PCDD/PCDF Projects

New Bedford Harbor - Mr. Emsbo-Mattingly was the project chemist for the New Bedford Harbor (NBH) Superfund Site during 2001. On behalf of USEPA and US Army Corps of Engineers, he helped orchestrate the collection of chemical data (PCBs, PAH, and metals) required for the dredge-design plan. In this capacity, he wrote the NBH Quality Assurance Project Plan and assisted with the NBH Field Sampling Plan. He promoted laboratory compliance with the project objectives through contracting (Statement of Work) and monitoring (Data Review, Data Validation, and Data Interpretation reports) systems.

Centredale Restoration Project –Formerly operated as a chemical manufacturer and drum recycling facility, the historic site activities included waste disposal, which is believed to be the source of PCDDs, PCDFs, hexachloroxanthene, pesticides, and PCB contamination at the site. Collectively, these persistent halogenated organic compounds migrated into proximal waterways. As part of a team lead by USEPA, USACE, and Battelle Memorial Institute, source and reference samples were compared to regional sediments to help confirm the nature and extent of the release. Using chemical fingerprinting and principal components analysis (PCA), Mr. Emsbo-Mattingly helped isolate and track the on-site contaminant signatures down gradient to the point at which they were no longer distinguishable from reference areas.

Wood Treater Project – A former wood treating facility allegedly caused PAH and PCDD/PCDF impacts in neighboring waterways. Historical data including regulatory compliance data were unable to recognize or delineate the chemical signature of source material in proximal sediments. Soils and sediments from the source, reference, and alleged release areas were collected and

analyzed by traditional methods with modification for the resolution of numerous additional isomers. The enhanced signature richness and multivariate statistics helped geospatially distinguish site and background related influences.

PCB Superfund Site in Alabama – A former PCB manufacturing facility allegedly released PCB Aroclors into proximal waterways and regional air systems. The transport of this material was identified by comparison of regional sediments and soils to samples collected around the production facility.

LCP Chemical Superfund Site – PCB impregnated materials were used during the manufacture of caustic soda, chlorine, and hydrochloric acid by the electrolysis of sodium chloride using mercury cells. PCBs and mercury measured in regional sediments were attributed to waste from this manufacturing process. A forensic analysis revealed multiple lines of evidence that suggested a significant portion of the PCBs were attributed to regional background.

Refinery Catalyst – PCB impregnated catalyst was used by a refinery laboratory. Waste catalyst was deposited in a wetland. PCB congener analysis and forensic techniques such as principal components analysis (PCA) were used to demonstrate the local footprint of the catalyst material. Regional sediments, waters, and fish tissue samples exhibited distinct compositional patterns that matched the background dataset.

Aluminum Smelting Plant – Environmental investigations revealed PCB soil contamination associated with the smelting pots. However, a number of Aroclors were identified that were not associated with the process. PCB fingerprinting techniques helped distinguish the Aroclor patterns that were attributed to weathering and those that represented Aroclors used by the plant.

PAH Source Identification Projects

Mr. Emsbo-Mattingly participated in more than fifty source identification projects involving the identification of petroleum tar and coal tar generated by carbureted water gas, oil gas, and coke ovens facilities. The historical practices at these sites included the manufacture, storage and distribution of chemical products from former MGPs, wood treatment plants, metallurgical industries, general construction, municipal installations, military bases, utilities and waste sites of many varieties. Several of these projects required the differentiation of releases from adjacent sites that produced and refined tar products, respectively. Often these projects required tracing tar signatures across plumes of independent origin, including background from urban runoff.

Edgewater Tar Refinery Plant – This plant manufactured tar products including Tarvia, Carbasota, creosote, and roofing tar from carbureted water gas and coal tars. Historical tar releases were differentiated from petroleum fuel oil, coal, and waste oil releases using advanced PAH, feedstock, and petrographic fingerprinting. The analysis also included calculations of crude tar consumption and tar product manufacturing rates using historical literature and plant specific records. These findings helped clarify the conceptual site model and resolve the allocation discussions.

West Virginia Coke Plant – The origin of PAHs down gradient of a byproduct coke oven plant and tar refinery was unknown. The alleged sources included coke breeze, coke, coal tar, and refined tar. A detailed characterization of the source materials and down stream soils and sediments demonstrated that the source was attributed to the tar refinery and not the coke breeze, coke, or coal. This finding helped clarify the conceptual site model and resolve the allocation discussions.

Massachusetts MGP Plant – This project focused on the release date and stability of tar residues from an MGP to down gradient sediments. The tar generation rate was estimated from gas production records over time using historical industry literature and site specific information. The fate and transportation analysis required a detailed study of tar weathering and stiffness, which were subsequently related to toxicity studies. The approximate period of release was determined with multiple lines of evidence, which included 1) the manufactured gas plant processes through diagnostic ratios and feedstock analysis and 2) the age of tar containing sediments using radioisotopes.

Ashland/NSP Lakefront Site – The origin of tar throughout this site was not clear. On behalf of USEPA Region 5 and WDNR, Mr. Emsbo-Mattingly employed environmental forensics techniques to demonstrate a pathway for hydrocarbons from a former MGP to the lakefront shoreline. On behalf of the PRP group, he helped identify sections of the Site that were used for wood treating operations.

Fire Investigations

Natural Coal Fires – Natural coal fires produce coal tar and hazardous emissions. As part of an academic collaboration, NewFields characterized a range of natural coal tars from Kentucky, Alabama, and Wyoming. While the environmental impact of these tars was proximal to the fires, the tar contaminants resembled many of the features of industrial coal tars. The results were published a four volume series on Coal and Peat Fires and the online Encyclopedia of Earth.

Navy Former Fire Training Areas - The impact of former fire training activities is often governed by site-specific factors, like period of operation, confining barriers, soil type, groundwater flow, and accelerant type. The potential influence of these factors was observed to varying degrees in samples collected from multiple sites in Maine and Massachusetts.

Superfund Projects

Neenah MGP Investigation - The site of this former MGP was subsequently occupied by a gasoline service station and other commercial enterprises. Funding for the cleanup was dependent on the identification of non-MGP petroleum residuals at the site that were readily discovered using advanced forensic chemistry methods.

Fairmont Coke Works Site - Black semi-solid material was recovered from a stream dividing two adjacent NPL-listed sites. One site was a coke works site and the other was a tar refining/chemical company. The migration potential of waste material from each site was evaluated in order to clarify the scope of each cleanup under Superfund.

Navy Former Fire Training Area - The impact of former fire training activities is often governed by site-specific factors, like period of operation, confining barriers, soil type, groundwater flow, and accelerant type. The potential influence of these factors was observed to varying degrees in samples collected from this location in Maine.

Sediment Investigations

The Massachusetts Water Resources Authority (MWRA) planned and built a large state-of-the-art wastewater treatment plant to abate the discharge of untreated and partially treated sewage to Boston Harbor. Effluent from the plant is discharged through a pipe running nine miles offshore to further improve the water quality in Boston Harbor and facilitate the dilution of effluent with minimal impact to the offshore environment. MWRA commissioned a comprehensive testing program of Massachusetts coastal sediments to monitor potential impacts of effluent from the Deer Island Plant. Monitoring stations were selected near Boston Harbor and the new outfall (nearfield) and throughout Massachusetts and Cap Cod Bays (farfield). Mr. Emsbo-Mattingly used principal components analysis (PCA) to evaluate compositional changes in selected sediment parameters (pesticides, PCBs, PAHs, metals, TOC and grain size) that occurred during the pre- and post-discharge periods (1992 to 2000 and 2001 to 2002, respectively). He used these same PCA techniques to evaluate changes in zooplankton over the same periods.

U.S. Naval Stations face complex environmental challenges that often arise when bases are closed or redeveloped for civilian activities. Mr. Emsbo-Mattingly participated in multiple shoreline and shipyard assessments for the purpose of identifying and distinguishing environmental impacts from Navy facilities and vessels from urban background and commercial industry. These sediment studies often require traditional chemical fingerprinting coupled with statistical pattern recognition (e.g., principal components analysis or PCA).

Petroleum Projects

Mr. Emsbo-Mattingly investigated more than 30 petroleum crude oil spills, petroleum and natural gas production well accidents, refineries, storage depots, pipelines, fracking operations to determine the nature and extent of petroleum releases. These investigations often involved an assessment of historical data, supplemental forensic chemical testing, process chemistry, and applicable background conditions. Many of these projects required geospatial and multivariate analysis of commingled contaminant plumes. The fate and transport of petrochemicals is often characterized using lines of evidence such as hydrocarbon chemistry (PAHs, geochemical biomarkers, saturates), isotopes, weathering patterns, field data, and many others.

Vapor Intrusion Source Identification Projects

Mr. Emsbo-Mattingly participated in more than twenty source identification projects involving the identification of petroleum, tar and chlorinated solvents in urban and residential areas. Central to these investigations is the identification of hazardous chemicals in ambient air resulting from human occupation verses soil gas constituents from vapor intrusion. These projects involved the characterization of volatile compounds from local industries, building materials, ambient air, biological metabolism, and ambient soil gas. These investigations also benefited from advanced air testing methods developed by NewFields that improved the fingerprinting capability of forensic investigations focused on compounds with multiple common origins.

Solvents and Dry Cleaners

McKesson Chemical in California – Two neighboring dry cleaning and solvent packaging plants resided above contaminated groundwater. An analysis of chlorinated solvents, degradation byproducts, and petroleum hydrocarbons helped identify the origin of groundwater contamination and migration pathways.

YMCA in New York – This investigation focused on the origin of chlorinated solvents and BTEX vapors in an athletic facility. A detailed analysis of the indoor air over time demonstrated that the chlorinated solvents originated from the locker room and maintenance closets. High concentrations of chloroform were traced to the pool area. The detection of 1,3-butadiene was attributed to a false positive.

Pesticide Manufacturers in Brazil – Chlorinated pesticide manufacturers employ a wide range of chlorinated solvents and petrochemicals. The wastes are compositionally varied and include mixtures of solvents and impurities. Undocumented wastes from these operations were found in soils and buried containers at several onsite and offsite locations. Chemical fingerprinting demonstrated that the co-occurrence of the complex solvent mixtures were able to identify the impacts of point sources in NAPL, soil and air.

Projects Commissioned by the Electric Power Research Institute (EPRI)

Project Manager for "Leaching Characteristics of PCB-Contaminated Soils." As project manager, Mr. Emsbo-Mattingly conducted a detailed literature review and a laboratory study of leaching and migration potential of PCBs present at electric utilities. Leaching potential was evaluated for bias using traditional EPA and custom congener-specific methods. Risk-based analytical techniques were developed using toxic equivalency factors (TEFs) that related the relative toxicity of PCB containing samples to a common toxicity scale defined for dioxin. These techniques provided relative scales for evaluating the toxicological impact of PCB-contaminated media.

Project Manager for "Comparative Assessment of Tar Fingerprinting Methods". This project compares traditional and emerging forensic methods for the provision of EPRI members with guidance on their use and applicability to MCP source identification projects. The primary

methods used in this study include gas chromatography/mass spectrometry (GC/MS), gas chromatography/isotope ratio mass spectrometry (GC/IRMS), and Fourier transformed ion cyclotron resonance mass spectrometry (FTICRMS). Data generated from these three methods will be used to determine the advantages and disadvantages of these methods for potentially identifying the extent of tar contamination down to approximately 10 mg/kg total PAH in sediment that are potentially impacted by urban runoff.

Projects Manager for "MGP" Source Characterization, Identification, and Fingerprinting." Mr. Emsbo-Mattingly served as project manager for this contract. His involvement included a detailed literature, field, and laboratory study of the formation, sources, and chemical composition of wastes, such as tars and oils, found at former MGP sites. In addition, this project involved the optimization of analytical methods for the analysis and interpretation of biogenic, pyrogenic, and petrogenic marker compounds.

Project Chemist for "Fate and Transport Study of Preserved Utility Poles." This project focused on the fate and transport of creosote and chlorophenol preservatives in treated utility poles and adjacent soils. Custom analytical methods were developed for the measurement of TPH, PAH, di- through penta-chlorophenols, cresols, quinoline, and carbazole. This project documented the hetergeneous distribution of target analytes in a variety of soil types based on more than 200 pole sites of various ages across the U.S. This study illustrated the complex compositional changes that occur as wood preservatives migrate through the environment and the importance of site-specific factors, like soil type, groundwater, and gravitational transport mechanisms.

Laboratory Quality Control/Quality Assurance

The ExxonMobil Upstream Research Laboratory (URL) is a world class facility that provides integrated geochemical analyses of samples and data collected from potential and active oil production fields in numerous countries. This laboratory has developed and utilized a wide range of testing methods in its pursuit the most accurate and precise data for its clients. In this ongoing process, Mr. Emsbo-Mattingly was commissioned to perform an independent review of its SOPs and QA/QC protocols to gage its capabilities and performance. This evaluation helped identify areas of performance excellence and prioritize areas of method development in a highly specialized niche of the laboratory industry.

Data and laboratory auditor for numerous organic and inorganic laboratories for compliance with prevailing regulatory parameters and project specific quality assurance plans.

Supervised laboratory quality control, laboratory certifications, blind proficiency evaluations, external/internal audits and data validation programs at E3I and META Laboratories. Authored the Laboratory Quality Assurance Plan and numerous QAPP's. Developed protocols for control charts, IDLs, MDLs, and reporting limits. Drafted special methods for PCB, herbicide and petroleum fingerprinting methods. Monitored laboratory compliance with EPA CLP, NYSDOH/DEC ELAP/ASP, and MADEP MCP protocols. Acquired/maintained laboratory certifications in MA, CT, RI, NH, VT and NY.

Analytical Chemistry & Laboratory Operations

Mr. Emsbo-Mattingly developed and implemented custom methods for site-specific data objectives. He consulted with clients interested in atypical methods and performance criteria. He advised clients with respect to legal compliance. He wrote project proposals. He retained final approval for all laboratory activities. He managed production, workflow, personnel, budgets, and long term strategic planning. He coordinated laboratory schedules for the timely completion of analytical projects. He evaluated laboratory operations and data for compliance with CWA, RCRA, CERCLA (CLP), NPDES, MADEP, MCP and MWRA regulations. He supervised personnel, conducted salary and performance reviews.

Mr. Emsbo-Mattingly developed several analytical methods for the analysis of gasoline (PIANO), fuel oil fingerprinting (EPA 8270C Mod.), PCB congeners (EPA 1664 Mod.), and derivatized herbicides (EPA 8150 Mod.). These methods served site-specific project objectives for environmental investigations at gasoline stations, electric power utilities, and chemical manufacturers.

Mr. Emsbo-Mattingly developed several analytical methods for the analysis of Volatile Petroleum Hydrocarbons (VPH) and Extractable Petroleum Hydrocarbons (EPH) as described by the Massachusetts Department of Environmental Protection (MADEP). The VPH/EPH methods were designed to provide a toxicologically meaningful replacement for traditional GC and IR methods for measuring Total Petroleum Hydrocarbons (TPH). At E3I, the implementation of these performance-based methods was centered on Purge and Trap GC/PID/FID, GC/FID and GC/MS. AT META, these methods employed Microscale Solvent Extraction (MSE) techniques followed by GC/MS and GC/FID analyses. Mr. Emsbo-Mattingly's experience with risk-based analytical methods influenced projects in New England, New York, New Jersey, Alaska, and Washington.

Analyzed volatiles (GC/MS/FID/ELCD/PID), semivolatiles (GC/MS/FID), TPH-GC fingerprinting, pesticide/PCB/herbicides (GC/ECD), and metals (ICP) using HP and PE instruments. Executed troubleshooting and maintenance of organic and inorganic instrumentation. Integrated mainframe instrument computer systems with PC-based software. Compiled reports for CLP and commercial clients.

Presentations

"High Resolution PAH Analysis of Hydrocarbon Products." Emsbo-Mattingly, S.D., E. Litman., Occhialini, J., Siegener, R. SETAC North America 34th Annual Meeting, Nashville, TN. November 19, 2013.

"Extended PAHs in Tar and Petroleum" Emsbo-Mattingly, S.D. and E. Litman. EPRI Manufactured Gas Plant 2013 Symposium, Savannah, GA. November 12, 2013.

"Environmental Forensics Workshop" Emsbo-Mattingly, S.D., Douglas, G.S., E. Litman. University of Massachusetts, Amherst, MA. 29th Annual International Conference on Soils, Sediments, Water and Energy, University of Massachusetts, Amherst, MA. October 21, 2013.

"High Resolution PAH Analysis for Risk Assessment and Source Identification." Emsbo-Mattingly, S.D., E. Litman, Occhialini, J., Siegener, R. University of Massachusetts, Amherst, MA. 29th Annual International Conference on Soils, Sediments, Water and Energy, University of Massachusetts, Amherst, MA. October 22, 2013.

"Chemical Characteristics and Molecular Interpretation of Solidified Tar in River and Coastal Sediments." Poster Presentation at the EPRI AEHS MGP 2012 Conference, Chicago, IL March 28, 2012.

"Environmental Forensics." Chair: Emsbo-Mattingly, S.D. and Saba, T. Society of Environmental Toxicology and Chemistry North America, 32nd Annual Meeting, Boston, Massachusetts. November 17, 2011.

"Traditional and Environmental Signatures of Indoor Air." Emsbo-Mattingly, S.D. Society of Environmental Toxicology and Chemistry North America, 32nd Annual Meeting, Boston, Massachusetts. November 14, 2011.

"Predicting Chemical Fingerprints of Vadose Zone Soil Gas and Indoor Air from Non-Aqueous Phase Liquid Composition." Uhler, A.D., McCarthy, K.J., Emsbo-Mattingly, S.D., Stout, S.A., and Douglas, G.S., 27th Annual International Conference on Soils, Sediments, Water and Energy, University of Massachusetts, Amherst, MA. October 19, 2011.

"How to Evaluate the Efficacy of Diagnostic PAH Source Ratios in Environmentally Weathered Soil Samples" Douglas, G.S., Uhler, A.D., McCarthy, K.J., Emsbo-Mattingly, S.D., Stout, S.A. University of Massachusetts, Amherst, MA. 27th Annual International Conference on Soils, Sediments, Water and Energy, University of Massachusetts, Amherst, MA. October 19, 2011.

"Factors to consider when constraining the time of release of gasoline LNAPL based on total lead concentration." Douglas, G.S., Emsbo-Mattingly, S.D, Stout, S.A., Uhler, A.D., McCarthy, K.J. 26th Annual International Conference on Soils, Sediments, Water and Energy, University of Massachusetts, Amherst, MA. October 20, 2010.

"Traditional and Forensic Signatures of Indoor Air." Emsbo-Mattingly, S.D. and Uhler, A.D. EPRI MGP 2010, San Antonio, TX. January 27, 2010.

"Natural Coal Tars: A Geological Contaminant." Emsbo-Mattingly, S.D., Stout, S.A., Stracher, G.B., and Hower, J.C., EPRI MGP 2010 Symposium, San Antonio, TX. January 27, 2010.

"Updated Summary of Regional and National Ambient Background Investigations for PAHs and Metals." Emsbo-Mattingly, S.D., Swanson, W., Henderson, J., and Parsons, S. The Annual International Conference on Soils, Sediments, Water, and Energy. Amherst, MA. Wednesday, October 21, 2009.

"Identifying Background." Emsbo-Mattingly, S.D., Stout, S.A. The Annual International Conference on Soils, Sediments, Water, and Energy. Amherst, MA. Wednesday, October 21, 2009.

"Environmental Forensics." Chair: Emsbo-Mattingly, S.D. Society of Environmental Toxicology and Chemistry North America, 29th Annual Meeting, Tampa, Florida. November 20, 2008.

"Predicting Chemical 'Fingerprints' of Vadose Zone Soil Gas from NAPL Composition." Uhler, A.D., McCarthy, K.J., Emsbo-Mattingly, S.D., Stout, S.A. and. Douglas, G.S. Society of Environmental Toxicology and Chemistry North America, 29th Annual Meeting, Tampa, Florida. November 20, 2008.

"Extractable PAHs in Coal: The Effects of Rank and Natural/Anthropogenic Coking." Emsbo-Mattingly, S.D., Stout, S.A. Stracher, G. B., and Hower, J.C. Society of Environmental Toxicology and Chemistry North America, 29th Annual Meeting, Tampa, Florida. November 20, 2008.

"Identifying Roadway Pavement in Proximal Soils and Sediments." Emsbo-Mattingly, S.D., Uhler, A.D., Stout, S.A., Douglas, G.S., and McCarthy, K.J. The 24th Annual International Conference on Soils, Sediments and Water. Amherst, MA. Thursday, October 23, 2008.

"Environmental Forensics Workshop." Emsbo-Mattingly, S.D., Stout, S.A., and Douglas, G.S. The 24th Annual International Conference on Soils, Sediments and Water. Amherst, MA. Tuesday, October 21, 2008.

"Environmental dangers of coal fires in Kentucky and Alabama." Stracher, G. B., Hower, J. C., Schroeder, P., Fleisher, C., Kitson, J., Barwick, L. H., Hiett, J., Mardon, S. M., Carroll, R. E., Emsbo-Mattingly, S. D. Geological Society of America, 2008 v. 40, p. 493.

"Regional and National Ambient Background Investigations for PAHs and Metals: Applications and Strategies for Environmental Professionals." Emsbo-Mattingly, S.D. The Third International Symposium and Exhibition on the Redevelopment of Manufactured Gas Plant Sites. Mystic, CT. September 25, 2008.

"PCB Chemical Forensics at the Lake Hartwell Superfund Site." Emsbo-Mattingly, S.D.; Magar, V.S.; Brenner, R.; and Mills, M.A. 23rd International Conference on Contaminated Soils, Sediments and Water, Amherst, MA. October 16, 2007.

"Applied Chemical Fingerprinting in Environmental Forensics." Stout, S.A.; Plantz, G.M.; Douglas, G.S.; and Emsbo-Mattingly, S.D. 23rd International Conference on Contaminated Soils, Sediments and Water, Amherst, MA. October 16, 2007.

"PAH Source Identification: A Multiple Method Approach." Emsbo-Mattingly, S. National Environmental Monitoring Conference, Cambridge, MA. August 20-23, 2007.

"Chemical Fingerprinting. Applications in Environmental Forensics Investigations." Uhler, A.D., Emsbo-Mattingly, S.D., Stout, S.A. Douglas, G.S., McCarthy, K.J. and Rouhani, S. 2007. Pp. 59-80 in: Defense Research Institute Toxic Torts and Environmental Law Seminar. New Orleans, LA.

"Non-MGP Sources of Pyrogenic PAHs: The Confounding Effects of Roadway Pavement, Soot, Rail Yard Wastes, and Construction Materials." Emsbo-Mattingly, S., Uhler, A.D. EPRI MGP 2007 Symposium: Advancements in Manufactured Gas Plant Site Remediation. Atlanta, GA January 8-11, 2007.

"A Forensic Method for Discerning Background Contributions During Vapor Intrusion Pathway Investigations." Plantz, G.M., Emsbo-Mattingly, S., McCarthy, K., Uhler, A.D. EPRI MGP 2007 Symposium: Advancements in Manufactured Gas Plant Site Remediation. Atlanta, GA January 8-11, 2007.

"Tar Formation and Alteration." Emsbo-Mattingly, S. EPRI MGP 2007 Symposium: Advancements in Manufactured Gas Plant Site Remediation. Atlanta, GA January 8-11, 2007.

"PCB-Source and Dechlorination Fingerprinting." Emsbo-Mattingly, S., V. Magar, Brenner, R., and M. Mills. Society of Environmental Toxicology and Chemistry (SETAC) Montreal, CA. November 8, 2006.

"Environmental Forensics in Sediment." Emsbo-Mattingly, S. Session Chair. Society of Environmental Toxicology and Chemistry (SETAC) Montreal, CA. November 8 2006.

"Coal Tar Genesis and Environmental Alteration." Emsbo-Mattingly, S. GTI Environmental Conference and Exhibition. Orlando, FL. October 23, 2006.

"Gas Phase Signatures of MGP Tar and Petroleum." Emsbo-Mattingly, S. Plantz, G., McCarthy, K. GTI Environmental Conference and Exhibition. Orlando, FL. October 24, 2006.

"Hydrocarbon Signatures Commonly Encountered in Urban Background Environments." Emsbo-Mattingly, S. GTI Environmental Conference and Exhibition. Orlando, FL. October 25, 2006.

"Determining the Source of PAHs in Sediments." Emsbo-Mattingly, S.D., Uhler, A.D., Stout, S.A., Douglas, G.S, and Coleman A. International Symposium and Exhibition of the Redevelopment of Manufactured Gas Plant Sites, Reading, U.K. April 2006.

"Forensic Characterization of Subsurface and Indoor Air for Evidence of Vapor Intrusion at Contaminated Sites." McCarthy, K.J., Mattingly, S.D., Uhler, A.D., Rezendes, A., Stout, S.A., and Douglas, G.S. 16th Annual AEHS Meeting & West Coast Conference on Soils, Sediments and Water, San Diego, CA. April 2006.

"Delaware River Refinery Effects Differentiated in Tissue, Sediment, and Dated Core Investigation." Stephen Emsbo-Mattingly, Allen Uhler, Lenwood Hall, Dennis Burton, Clark Alexander, and Bo Liu. Society of Environmental Toxicology & Chemistry, Annual Meeting, Baltimore, MD. November 2005.

"A Source Identification and Risk Assessment Approach for Sediment Investigation in Narragansett, Rhode Island" Emsbo-Mattingly, S.D., Hinckley, D., Speicher, J., Yeutter, L., and Leather, J. Society of Environmental Toxicology & Chemistry, Annual Meeting, Baltimore, MD. November 2005.

"A Streamlined Approach for Conducting a Screening-Level Ecological Risk Assessment of a Marine Harbor." Hinckley, D., Speicher, J., Leather, J., Emsbo-Mattingly, S.D., Yeutter, L., and Powell, M. Society of Environmental Toxicology & Chemistry, Annual Meeting, Baltimore, MD. November 2005.

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"Symposium on Testing Methods for Oil and Hazardous Materials: Using EPA SW-846", Independent Testing Laboratory Association Northeast Regional Conference, Stephen Emsbo-Mattingly (Chair) and Barry Lesnik (USEPA OSW Methods Program Manager) (Featured Presenter), Worchester, MA. March 22, 2001.

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Attachment 2
Expert Service Record for Stephen D. Emsbo-Mattingly, M.S.

www.NewFields.com 300 Ledgewood Place, Suite 305, Rockland, Massachusetts 02370 T. 781.681.5040

Deposition, Testimony, and Expert Designations
Stephen D. Emsbo-Mattingly, M.S.
Through July 2014

Designated expert retained by Richard Catena in Richard Catena v. Raytheon Company, et als. Docket No. BER-L-001267-11 in the Superior Court of New Jersey for the Law Division of Bergen County. Retaining lawyer was Janine G. Bauer of Szaferman, Lakind, Blumstein, & Blader, P.C..

- Expert report dated September 11, 2012.
- Deposition dates January 16, 2013; January 17, 2013; and February 1, 2013.

Designated expert retained by Port of Alabama State Docks in State of Alabama., et al. v. Alabama Wood Treating Corporation, et al., Case No. 1:85-cv-0642-CG-C in the United States District Court for the Southern District of Alabama Southern Division. Retaining lawyer was Walter Cook of Lyons, Pipes & Cook.

- Expert report dated September, 2009.
- Deposition dated November 19, 2009.

Designated expert retained by Xcel Energy in the Northern States Power v. Admiral Insurance Co., et al. Wisconsin Circuit Court Case No. 03-CV-753. The retaining lawyer was Cynthia Smith of Michael Best & Friedrich LLP.

- Expert report dated February 2006.
- Deposition dated May17, 2006.

Designated expert retained by Xcel Energy in the St. Paul Mercury Insurance Company and St. Paul Fire and Marine Insurance Company v. Northern States Power in Minnesota Fourth Judicial District Case No. CT 03-017809. The retaining lawyer was Cynthia Smith of Michael Best & Friedrich LLP.

- Expert report dated February 2006.
- Deposition dated May17, 2006.

Designated expert retained by Cardi Construction v RIDEM regarding the use of urban fill as detailed in OC&I/Site Remediation File No. 2007 - 598 in the Town of Glocester, RI.

- Expert report dated April 2010.

Designated expert retained by the Edgewater Superfund Advisory Group in its mediation with Honeywell at the Quanta Superfund Site in Edgewater N.J.

- Mediation dated March 2012

Attachment 3
Documents Reviewed and Relied On

www.NewFields.com 300 Ledgewood Place, Suite 305, Rockland, Massachusetts 02370 T. 781.681.5040

Author	Date	Title	Bates No.
Aguirre, F.N.	2/4/2014	Deposition	
Brewer, J.R.	4/4/2014	Deposition	
Collison, G.	9/15/2010	Deposition	
Collison, G.	10/28/2011	Expert Report of Gary Collison, P.E. Ward Transformer Superfund Site Removal Action	
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Golder Associates Inc.	10/10/2007	Ward Transformer Site Removal Action Plan Progess Report Dated September 2007	GOLDER012669
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Golder Associates Inc.	9/10/2008	Ward Transformer Site Removal Action Plan Progess Report Dated August 2008	GOLDER037725
Golder Associates Inc.	11/10/2008	Ward Transformer Site Removal Action Plan Progess Report Dated October 2008	GOLDER045687
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Golder Associates Inc.	1/12/2009	Ward Transformer Site Removal Action Plan Progess Report Dated December 2008	GOLDER060531
Golder Associates Inc.	2/10/2009	Ward Transformer Site Removal Action Plan Progess Report Dated January 2009	GOLDER066612
Golder Associates Inc.	3/12/2009	Ward Transformer Site Removal Action Plan Progess Report Dated February 2009	GOLDER069695
Golder Associates Inc.	3/12/2009	Ward Transformer Site Removal Action Plan Progess Report Dated February 2009	GOLDER069695
Golder Associates Inc.	4/14/2009	Ward Transformer Site Removal Action Plan Progess Report Dated March 2009	GOLDER071648
Golder Associates Inc.	5/12/2009	Ward Transformer Site Removal Action Plan Progess Report Dated April 2009	GOLDER076769
Golder Associates Inc.	6/12/2009	Ward Transformer Site Removal Action Plan Progess Report Dated May 2009	GOLDER078606
Golder Associates Inc.	7/10/2009	Ward Transformer Site Removal Action Plan Progess Report Dated June 2009	GOLDER080315
Golder Associates Inc.	8/13/2009	Ward Transformer Site Removal Action Plan Progess Report Dated July 2009	GOLDER082999
Golder Associates Inc.	9/15/2009	Ward Transformer Site Removal Action Plan Progess Report Dated August 2009	GOLDER085396
Golder Associates Inc.	10/13/2009	Ward Transformer Site Removal Action Plan Progess Report Dated September 2009	GOLDER086895
Golder Associates Inc.	11/11/2009	Ward Transformer Site Removal Action Plan Progess Report Dated October 2009	GOLDER088854

Author	Date	Title	Bates No.
Golder Associates Inc.	12/16/2009	Ward Transformer Site Removal Action Plan Progess Report Dated November 2009	GOLDER090342
Golder Associates Inc.	1/18/2010	Ward Transformer Site Removal Action Plan Progess Report Dated December 2009	GOLDER092136
Golder Associates Inc.	2/17/2010	Ward Transformer Site Removal Action Plan Progess Report Dated January 2010	GOLDER093683
Golder Associates Inc.	3/19/2010	Ward Transformer Site Removal Action Plan Progess Report Dated Febuary 2010	GOLDER095631
Golder Associates Inc.	4/26/2010	Ward Transformer Site Removal Action Plan Progess Report Dated March 2010	GOLDER098252
Golder Associates Inc.	5/19/2010	Ward Transformer Site Removal Action Plan Progess Report Dated April 2010	GOLDER100806
Golder Associates Inc.	6/29/2010	Ward Transformer Site Removal Action Plan Progess Report Dated May 2010	GOLDER103716
Golder Associates Inc.	7/28/2010	Ward Transformer Site Removal Action Plan Progess Report Dated June 2010	GOLDER105110
Golder Associates Inc.	8/30/2010	Ward Transformer Site Removal Action Plan Progess Report Dated July 2010	GOLDER107311
Golder Associates Inc.	10/4/2010	Ward Transformer Site Removal Action Plan Progess Report Dated August 2010	GOLDER108098
Golder Associates Inc.	11/15/2010	Ward Transformer Site Removal Action Plan Progess Report Dated September 2010	GOLDER108376
Golder Associates Inc.	11/22/2010	Ward Transformer Site Removal Action Plan Progess Report Dated October 2010	GOLDER089838
Golder Associates Inc.	12/17/2010	Ward Transformer Site Removal Action Plan Progess Report Dated November 2010	GOLDER111478
Golder Associates Inc.	6/11/2011	Ward Transformer Site Removal Action Plan Progess Report Dated March, April and May 2011	GOLDER112462
Stanley, J.	3/1/1994	NC DEHNR Preliminary Assessment Ward Transformer Company	EPA-FOIA 00000006
Stanley, J.	7/1/1998	NC DENR Expanded Site Inspection Ward Transformer Site	EPA-FOIA 00000471
Weston Solutions, Inc	9/1/2004	Ward Transformer Site Revised Remedial Investigation and Risk Assessment Report, Volume 1	GOLDER000001
Weston Solutions, Inc	9/1/2004	Ward Transformer Site Revised Remedial Investigation and Risk Assessment Report, Volume 2	GOLDER000612

Attachment 4

Ward Transformer Site Database

www.NewFields.com 300 Ledgewood Place, Suite 305, Rockland, Massachusetts 02370 T. 781.681.5040